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FRENCH MILITARY APPLICATIONS OF VIRTUAL REALITY

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INTRODUCTION

France is now applying virtual reality techniques to military purposes. In parallel, France is conducting studies related to the psychological effects of immersion.

Our approach is based on the creation of synthetic environments in which men are more or less immersed. Besides we have been searching for the means that will give the best price/quality ratio. This resulted in creating environments which are both simplified and improved with respect to the actual environment. This document describes some current applications.

The 5 H's

First, it is necessary to define the range in which the virtual reality techniques will be applied. In our opinion, these techniques can be applied to five fields, i.e. the 5 Hs:

1. Help for design,
2. Help for test,
3. Help for training,
4. Help for mission preparation,
5. Help during operations.

1. This application is currently being undertaken at the Etablissement Technique d'Angers (ETAS). The purpose is to be able to simulate vehicle compartments and to analyse them in dynamic conditions.
2. It will be possible to use the above application to perform tests on currently developed equipment. This corresponds to the second type of application.
3. The third application is for personnel training and instruction.
4. The fourth application is related to the preparation of missions. Works are in progress to help special units to prepare interventions. The purpose is to replace the old sandboxes or even the real-size site reconstruction techniques with synthetic environments where soldiers can repeat the various actions to be carried out.
5. The fifth application for which we will give an example, is related to the use of these synthetic environments as an assistance during actual missions.

To illustrate training assistance, we will give three examples corresponding to different degrees of immersion. The first one is for parachuting, the second one for resuscitation gestures, and the third one is a film related to Leclerc tanks crew training.
Finally, an example will illustrate the use of these techniques as an assistance during a real mission.

Parachuting

The developed simulator is very similar to the one developed by Systems technology, Inc. The data processing means involved in its creation are not expensive. The synthetic environment is a simplified representation of the training environment that includes part of the Etablissement Technique d'Angers (ETAS). The parachute drift laws have been established from data recorded in flight by test parachutists of the Airborne Centre of Toulouse (CAP).

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A special effort has been made to simplify at the maximum the simulation supervision operations. The jump can be recorded and then shown to the trainee. It is also possible to modify meteorological parameters.

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The trainee can see both the parachute and his/her feet. In this application, the parachutist and his/her harness are immersed. The only "non-realistic" interface is the virtual reality helmet. The control actions are performed by acting on the real controls of the parachute.
This type of simulator, with its simple architecture and the reduced number of interfaces, has been received positively by professionals.

Front-Line Medical Care

The basic characteristic of France is advanced front-line medical care with the practice of medical and surgical operations on the actual combat spot.

The current type of military intervention is characterized by the engagement of a low-strength unit for which medical support is provided by a unit doctor who has a front-line armoured ambulance which can be used to evacuate wounded personnel. Very often, this involves emergency resuscitation which requires the practice of elementary resuscitation gestures. These gestures are characterized by the fact that they must be done blind, whether inserting a perfusion in the jugular vein, anaesthetizing the brachial plexus or placing a cannula in the trachea. Sometimes these operations have to be done inside the vehicle, in combat gear, with a heavy helmet and a bullet-proof vest; therefore, it takes place in a narrow, cramped space which is often hot and noisy and sometimes the individual is restricted in movement. The posture is often uncomfortable with the presence of combat stressors, in particular enemy fire. In addition, these operations are carried out by general practitioners.

In this context, Chief Medical Officer TRIFOT, director of CITERA in Lyons, had the idea of launching a training project using virtual reality techniques for the teaching of elementary resuscitation gestures. This project is partly financed by "Mission Innovation" at the DGA and involves different partners which, in addition to CITERA, include the Human Factors division of Etablissement Technique d'Angers (ETAS), the University of Angers, the Laboratoire Robotique de Paris and a firm of architects (Pierre Granjean).
At present, the tool is used as follows. The students learn to perform gestures by initially regarding the in-depth anatomy of the neck and the route followed by the needle in it. The pertinent elements of this anatomy are reinforced by colours. Subsequently, the student repeats these gestures while only seeing the skin but having an enhanced return of the manual sensation. Finally, he performs the activity with the same work field as in reality, i.e. with little manual sensation and a view of just the surface of the region. In terms of verification when the act is performed, the student can see the result by displaying the position of the needle in depth.

The last stage of training consists in doing this task in the GEPAT (Générateur d'Environnement Physique Aggressif pour le Travail). In addition to confinement, this generator, developed under the responsibility of Laurent Todeschini, ETAS, produces noise, heat, movement and hypoxy. The task is performed wearing combat gear, a bullet-proof vest and a heavy helmet.

To conclude, such a product should enable doctors to be trained how to operate in any critical situation through learning not only the technique but also the ability to face up to it.

The studies already carried out in the framework of this project lead us to draw a parallel between this front-line medical facility and manual mine-clearing actions: this resulted in the study of a device for exploration of heterogeneous layers, in both the mine-clearing and the medical fields.

Leclerc Tank Crew Training

The film shows a specific application where the immersion is obtained via a tank simulator that allows interactive training of the three crew members. This device is now operational and used to train all the Leclerc tank crews.

Assistance during Missions : Definition of a Virtual Area for Action (DEVA - Définition d'un Espace Virtuel pour l'Action)

The last presentation of this summary deals with the use of synthetic environments as an assistance to drive vehicles. The developed device includes an ETAS geographical database used to supply the drivers with a full-size reproduction of the field with a precision of +/- 2 cm for roads and 1 to 10 m for the rest of the area. In addition to this geographical

data, it is possible to integrate information such as road signs or identification of dangerous areas. As the driven vehicle is equipped with video cameras, it is possible to supply the pilot with a navigation aid by superimposing on the real images the synthetic information generated by the application.

The second driving mode is the "blind" mode (i.e., without seeing the outside of the vehicle and helped only by the synthetic geography). Note that the position of the vehicle is given with a precision lower than 7 cm by a GPS coupled with an on-board system. The tests performed in these conditions show that the pilots could drive their vehicles in "blind" conditions at a speed of approximately 45 km/h.

In addition to the above driving modes ensured by this device is the "God's eye view" mode: it can be compared with the way a child drives a remotely-controlled car. The future trajectories of the vehicle can be anticipated since this mode offers a long-distance vision. We can easily imagine its tactical applications. It is also possible to superimpose on this synthetic image the image of the actual landscape, for example from an infra-red camera showing obstacles. This allows driving by night without lights and in foggy conditions.
This application offers a high potential and in the future, instead of these screens, it should be possible to make a projection of the synthetic environments directly on the windscreen.